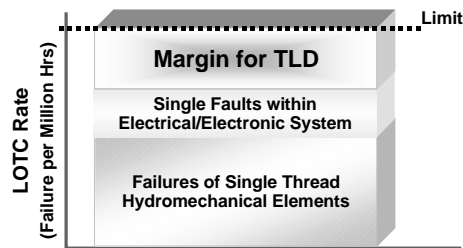


## Time Limited Dispatch

### *Time Limited Dispatch (TLD)*



1

### *What are the best practices regarding the application of TLD for the engine control systems?*

- Develop a Markov Model (MM) to estimate the average failure rate of the control system
  - Markov Models are reasonably simple to construct (see ARP 5107) and have the advantage that repair rates are easily simulated
  - For repair times that are much more frequent than the MTBF times of the various system elements, a single state model is an adequate representation of the system - single state models are ones where each single fault state is simulated AND the next fault is one that directly leads to an Loss-of-Thrust-Control (LOTC) event (see update to ARP 5107, due ≈ June, '04)

5 May 2004

ANE DER Conference

2

## Time Limited Dispatch

*What are the best practices regarding the documentation of TLD for the engine control systems?*

- Document the system analysis for FAA review, and approval of TLD operations
  - Put "display and repair requirements" relating to TLD operations in the Airworthiness Limitations Section of the engine's Instructions for Continued Airworthiness - see ANE policy Letter ANE-1993-33.28TLD-R1, "Policy for Time Limited Dispatch (TLD) of Engines Fitted with Full Authority Digital Engine Controls (FADEC) Systems", of June 29, '01

5 May 2004

ANE DER Conference

3

*Do all programs use a TLD summary document to explain the dispatch criteria?*

- **No.** Previous programs have not done this AND this has caused some difficulty
  - Some applicants put the full LOTC reliability analysis, with the resulting dispatch criteria, into one document - WHICH the applicant considers proprietary to the company. Thus, the source of the dispatch criteria is not available to the operators.
- **Recommendation:** The applicant should create a summary document that contains a table of the various system faults and the required repair times for those faults.

5 May 2004

ANE DER Conference

4

## Time Limited Dispatch

*Should the TLD analysis report only address control systems failures that lead to LOTC events, or should it include all the secondary system faults, such as loss of display information, as well?*

- The analysis should include all control system faults that lead to LOTC events as well as secondary system faults, such as the loss of a display parameter processed by the electronic control unit, if the loss of that parameter would result in a flight crew initiated IFSD.

5 May 2004

ANE DER Conference

5

*Do all TCDS documents contain a note that explicitly indicates TLD approval?*

- No. If the TCDS does not indicate that TLD operations have been approved, then full-up control system operation is required at each dispatch.
- NOTE: When the TCDS indicates that TLD operations have been approved, the time limitations do not have to be stated on the TCDS. The engine Limitations Sections of the ICA's is the place to put them. (See ANE Policy letter in TLD.)

5 May 2004

ANE DER Conference

6

## Time Limited Dispatch

### *Do applicants show the TLD summary tables in the control systems' Plan for Software Aspects of Certification (PSAC)?*

- No. The TLD analysis and time limits established for TLD operations should be contained in other, separate documentation

5 May 2004

ANE DER Conference

7

### *What do aircraft maintenance documents have to say about TLD and how is it applied?*

- Generally, the aircraft's maintenance documents will contain the engine's Limitations in a section titled "Maintenance Sensitive Items", or similar title. However, this is not required. Engine Limitations stand on their own
- An operator has to show that his operation and maintenance plan for the aircraft complies with all aircraft AND engine Limitations.
- If the aircraft manufacturer wants to be more restrictive with TLD operations than the limitations approved for the engine, that is certainly acceptable.
  - In this case, the aircraft manufacturer should place his more restrictive requirements in the aircraft's Limitations section of the aircraft's Instructions for Continued Airworthiness.

5 May 2004

ANE DER Conference

8

## Time Limited Dispatch

*Do the other engine program project leads at the FAA understand all these considerations?*

Not sure they ALL do.  
So, when there is confusion, contact

Gary Horan @ 781-238-7164

e-mail: gary.horan@faa.gov

or

Norm Brown @ 781-238-7181

e-mail: normal.brown@faa.gov

or,

Hals Larsen @ 425-917-6582

e-mail: hals.larsen@faa.gov

5 May 2004

ANE DER Conference

9

### *What is an MMEL vs MEL? (con't)*

- The MMEL is the aircraft's Master Minimum Equipment List.
  - It is an FAA approved document, published by the aircraft manufacturer for each type design aircraft.
  - The MMEL is a list of equipment that is allowed to be inoperative at dispatch (for a limited period of time).
  - There may be a crew procedure, a maintenance action or aircraft performance penalty associated with the inoperative item.

5 May 2004

ANE DER Conference

10

# Atlantic City DER Recurrent Seminar – May 5, 2004

## Time Limited Dispatch

### *What is an MMEL vs MEL? (con't)*

- An MEL is an operator's Minimum Equipment List for an aircraft type.
  - An MEL can be more restrictive than the manufacturer's MMEL for the aircraft, by either not allowing an item to be inoperative at dispatch or requiring it to be repaired sooner than required by the MMEL.
  - However, the MEL cannot be less restrictive than the MMEL for that aircraft.

5 May 2004

ANE DER Conference

11

### *Does there have to be an MMEL (and associated MEL) listing for any (and all) items known to be inoperative at dispatch?*

- No, though many believe so...
  - There are many systems on an aircraft which may contain inoperative elements, where the inoperative elements (or faults) are considered to have a minor impact on aircraft integrity.
  - No MMEL (or MEL) listing of these fault conditions is necessary when discovery and repair of those faults is covered by the operator's maintenance plan for the aircraft - even if the fault is discovered prior to the planned inspection/repair time interval.
  - When finding such a fault prior to the planned inspection/repair activity, maintenance should file a Non-Routine Maintenance/Inspection Card indicating the existence of the fault and the scheduled (planned) repair of the fault.

5 May 2004

ANE DER Conference

12

## Time Limited Dispatch

### *MMEL vs. Planned Maintenance Approach for Dispatchable (St & LT) FADEC system faults*

- Hence, there are three approaches for addressing FADEC system faults
  - Use the MMEL (and MEL) approach for all faults
    - For example, UA uses this approach for all FADEC system faults (which affect the LOTC rate) on their 767 and 747-400 aircraft. (UA only has no-dispatch and ST messages)
  - Use the MMEL approach for some faults and a planned maintenance (i.e., inspection/repair) approach for other faults
    - This is the most common approach used. AA, Delta, and many others this approach on their Boeing, Airbus, Bombardier, and Embraer aircraft.
  - Use a planned maintenance approach for all faults
    - This approach is used on all Boeing 737 600-900 aircraft.

5 May 2004

ANE DER Conference

13

### *FADEC System short term (ST) and long term (LT) Faults*

- As indicated above, most operators use a combination of the MMEL (MEL) and planned maintenance approaches to handle FADEC system faults
  - ST faults are addressed using the MMEL (MEL) approach
  - LT faults are addressed in the operator's maintenance plan by using a periodic inspection/repair strategy to find and fix these faults.

5 May 2004

ANE DER Conference

14

## Time Limited Dispatch

### *Repair Intervals (or times) used in the TLD analysis*

- Almost all TLD analyses, including all Markov modeling simulations of a system, simulate repair times for a fault (or faulty condition) in a time-since-fault manner.
- That is, the time of occurrence of the fault is known, and the analysis will yield the required repair time - to achieve the defined "average" LOTC rate.

5 May 2004

ANE DER Conference

15

### *TLD Time intervals: What has to be fixed? and when?*

- When using the MMEL (MEL) approach:
  - The time of the occurrence of the fault (or faulty condition) is known and the MMEL (MEL) will indicate the time allowance for operation with that condition (i.e., it must be repaired within that time).

5 May 2004

ANE DER Conference

16



## Time Limited Dispatch

### *TLD Time intervals: (con't)* *What has to be fixed? and when?*

- When using the planned maintenance, inspection/repair approach:
  - If the time of occurrence is not known, the system should be cleared of all faults in the group being addressed with this approach by using an inspection/repair interval that is not greater than twice the time-since-fault "time limitation" specified for faults in that group.
  - This will ensure that the "average" operating time of the faults being addressed using the inspection/repair strategy does not exceed the maximum specified time-since-fault operating time for those faults.

5 May 2004

ANE DER Conference

17

### *When Using the periodic Inspection/Repair Approach*

- If the faults in this group have an "approved" time time/date stamp associated with the fault AND the operator wants to handle all faults in the group individually, then
  - each fault should be repaired within the operating time limitation given for that group of faults, and
  - the operating time "starts" with the time/date stamp for the fault.

5 May 2004

ANE DER Conference

18

Atlantic City DER Recurrent Seminar – May 5, 2004

## Time Limited Dispatch

